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(71) Applicant : SATAKE ENG CO LTD

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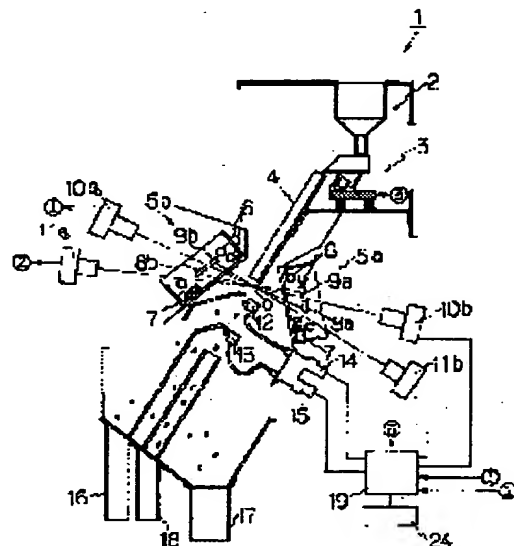
(72) Inventor : SATAKE SATORU
FUKUMORI TAKESHI
ITO TAKAFUMI

(54) GRANULAR MATERIAL SORTING METHOD AND GRANULAR MATERIAL SORTING DEVICE

(57) Abstract:

PROBLEM TO BE SOLVED: To enable classification of defective products from foreign matter to be performed, which has been a separate work without wasting time for the work of removing foreign matter from among defective products, without adopting a new device separately from a color sorting device for it and without largely changing the constitution of a conventional granular material color sorting device capable of sorting defective products from foreign matter, by only adding some to the conventional device.

SOLUTION: This granular material sorting device is provided with: a feeder 3 for transferring raw material to be sorted containing good products/defective products of an object to be sorted and other foreign matter; an optical part 5 for irradiating visible light and near infrared light to the moving raw material to be sorted; a controller 19 for subjecting optical information obtained from the raw material to be sorted to light receiving analysis; a solenoid valve 15 and an injector 13 for removing and sorting defective products from the raw material to be sorted based on analysis results of the optical information concerning the visible light received by CCD sensors 11a, 11b; and a solenoid valve 14 and an injector 12 for removing and sorting foreign matter from the raw material to be sorted based on the analysis results of the optical information concerning the near infrared light received by light receiving NfR sensors 10a, 10b.



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CLAIMS

[Claim(s)]

[Claim 1] The process to which the sorted out raw material containing the excellent article and defective of a sorting object, and the other foreign matter is moved, The process which irradiates the light and near-infrared light at the sorted out raw material which moves, and the process which carries out light-receiving analysis of the optical information about the light obtained from a sorted out raw material, The process which carries out light-receiving analysis of the optical information about the near-infrared light obtained from a sorted out raw material, The granular object sorting technique characterized by having the process which carries out exclusion sorting of the defective from a sorted out raw material based on the analysis result of the optical information about the light which received light, and the process which carries out exclusion sorting of the foreign matter from a sorted out raw material based on the analysis result of the optical information about the near-infrared light which received light.

[Claim 2] The granular object sorting technique according to claim 1 characterized by to have the process which carries out exclusion sorting of the foreign matter from the sorted out raw material which contains the process which carries out exclusion sorting of the foreign matter from a sorted out raw material, the defective subsequently acquired in the aforementioned process based on the analysis result of the optical information about near-infrared light, and a foreign matter based on the analysis result of the optical information about near-infrared light while exclusion sorting of the defective is carried out from a sorted out raw material based on the analysis result of the optical information about the light.

[Claim 3] The optical information about the light and the optical information about near-infrared light in the process which carries out exclusion sorting of a defective and the foreign matter from a sorted out raw material based on the analysis result of the optical information about the light and the analysis result of the optical information about near-infrared light are the granular object sorting technique according to claim 2 characterized by obtaining from the same view.

[Claim 4] The granular object sorting technique according to claim 1 characterized by performing the process which is equipped with the process which carries out exclusion sorting of the foreign matter from a sorted out raw material based on the analysis result of the optical information about near-infrared light, and the process which carries out exclusion sorting of the defective from a sorted out raw material based on the analysis result of the optical information about the light, and eliminates a foreign matter ahead of the process which eliminates a defective.

[Claim 5] The granular object sorting technique according to claim 4 characterized by estranging and allotting the process which carries out sorting exclusion of the foreign matter, and the process which carries out sorting exclusion of the defective on the same passage of a sorted out raw material.

[Claim 6] The optical information about near-infrared light and the optical information about the light are the granular object sorting technique according to claim 4 characterized by obtaining from the same view.

[Claim 7] A supply means to supply the sorted out raw material containing the excellent article and defective of a sorting object, and the other foreign matter, An optical irradiation means to irradiate the light and near-infrared light at the sorted out raw material supplied, A light-receiving means to receive the optical information acquired from a sorted out raw material, and an analysis means to analyze the optical information which received light, A defective exclusion means to drive by the

detecting signal of the defective in the sorted out raw material based on the analysis result of the optical information about the light of the aforementioned light-receiving means, The granular object selector characterized by having a foreign matter exclusion means to drive by the detecting signal of the foreign matter in the sorted out raw material based on the analysis result of the optical information about the near-infrared light of the aforementioned light-receiving means, and a control means to control each aforementioned means.

[Claim 8] The granular object selector according to claim 7 characterized by having the defective in the sorted out raw material based on the analysis result of the optical information about the light, and the analysis result of the optical information about near-infrared light, the defective and foreign matter exclusion means which are driven by any one detecting signal of the foreign matter, and a foreign matter exclusion means to drive subsequently by the detecting signal of the foreign matter in the sorted out raw material based on the analysis result of the optical information about near-infrared light.

[Claim 9] It can set for the defective and a foreign matter exclusion means drive by any one detecting signal of the defective in the sorted out raw material based on the analysis result of the optical information about the light, and the analysis result of the optical information about near-infrared light, and the foreign matter. A light-receiving means to receive the optical information about the light obtained from a light-receiving means to receive the optical information about the near-infrared light obtained from a sorted out raw material, and a sorted out raw material is a granular object selector according to claim 8 characterized by acquiring an optical information from the same view.

[Claim 10] An optical irradiation means to irradiate a supply means to supply a sorted out raw material, and the light and near-infrared light, A light-receiving means and the primary sorting means equipped with the defective and the foreign matter exclusion means, and a supply means to supply a sorted out raw material, The granular object selector according to claim 8 characterized by having a conveyance means to convey the defective and foreign matter obtained by a secondary sorting means and a primary sorting means equipped with an optical irradiation means to irradiate near-infrared light, and a light-receiving means and a foreign matter exclusion means for the supply means of a secondary sorting means.

[Claim 11] A defective exclusion means to drive by the detecting signal of the defective in the sorted out raw material based on the analysis result of a foreign matter exclusion means to drive by the detecting signal of the foreign matter in the sorted out raw material based on the analysis result of the optical information about near-infrared light, and the optical information about the light is a granular object selector according to claim 7 characterized by allotting a foreign matter exclusion means to the position operated ahead of a defective exclusion means.

[Claim 12] The granular object selector according to claim 11 characterized by arranging with an arbitrary spacing on the same passage of a sorted out raw material in the order of a foreign matter exclusion means and a defective exclusion means.

[Claim 13] A light-receiving means to receive the optical information about the light obtained from a light-receiving means to receive the optical information about the near-infrared light obtained from a sorted out raw material, and a sorted out raw material is a granular object selector according to claim 11 characterized by acquiring an optical information from the same view.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] The optical informations acquired by the sorted out raw material by irradiating light, such as the reflected light and the transmitted light, are analyzed, and it is the granular object sorting technique and its equipment for removing an unnecessary defective and an unnecessary foreign matter from a sorted out raw material, and a foreign matter is further removed from the mixture of the defective removed from the sorted out raw material, and a foreign matter, or it is related with the granular object sorting technique and its equipment for removing a foreign matter and a defective in order from a sorted out raw material.

[0002]

[Description of the Prior Art] Since it is well-known technique, classifying a sorted out object by sorting which detects the color of a granular object mentions and explains especially color sorting of grain to an example. If the light and near-infrared light are irradiated for example, at the raw material white rice which is a sorted out object, the tinction grain contained in a raw material white rice is detectable from the grain-of-rice reflected light obtained by irradiating the light. In this case, a tinction grain serves as a defective. Moreover, foreign matters, such as a stone contained in a raw material white rice, mud, and glass, are detectable from the foreign matter transmitted light or the reflected light obtained by irradiating near-infrared light. Moreover, color sorting was used, in order for the signal of the defective detected by the lightwave signal by these lights and the lightwave signal by near-infrared light and a foreign matter to drive one sorting means (ejector) and to remove these tinction grain and a foreign matter as a defective from a raw material white rice conventionally [both]. Therefore, sorting was two sort sorting with a white rice, and the other other defective and foreign matter.

[0003] By the way, although sorting out secondarily again, using as a raw material the defective and foreign matter eliminated by primary sorting with primary and a secondary sorting method at the basis of this technique, removing the excellent article with which mixing is expected here, and returning this to the feed zone of primary sorting is performed To be able to be made to carry out to others selling use was needed after secondary sorting rather than it sorted out the defective and foreign matter removed by primary sorting secondarily and it returned it to the raw material of primary sorting by the work which removes an excellent article by secondary sorting, since mixing of a defective and a foreign matter is expected again.

[0004] Thus, the mixture of the defective and foreign matter removed and sorted out from the raw material white rice was not able to be sold, if it remained as it is, since the stone which is the foreign matter sorted out simultaneously, mud, and glass were contained, although it is used in many cases as feed of livestock, since a defective is grain. Therefore, spending time on the work which removes these foreign matters after color sorting, in order to sell, or needing equipment with another color sorting for the reason is [0005] which is the present condition. Moreover, although the technique which burned by detection of the red by the reflected light and the transmitted light of the light, considered as rice, and enabled sorting of ***** as conventional three sort sorting is indicated by JP,54-78190,A, it is not a thing for the sorted out object containing the foreign matter, near-infrared light is not used, but these may say that sorting of a foreign matter is impossible.

[0006] Moreover, although the technique which carries out exclusion sorting of the excellent article

and the defective, and foreign matter by the light and near-infrared light by the ejector corresponding to each is indicated to US JP,5,B and No. 353,937 By the lightwave signal by the near-infrared light obtained from a sorted out object, and the lightwave signal by the light It judges whether a sorted out object is an excellent article or it is a defective, and whether it is a foreign matter, the circuit containing the matrix for sending out a signal only to the optimum ejector for the sorted out object used as an object etc. is needed, and a circuit becomes complicated. Incidentally, the summary of this application sets up suitably the time delay and injection time according to the object which carries out exclusion sorting, and applies them.

[0007]

[Problem(s) to be Solved by the Invention] From the above, thing, spend time by the work which removes a foreign matter from the conventional defective in this invention, or Therefore, without putting in new equipment other than a color selector Fractionation with the defective and foreign matter used as another work is enabled, without changing greatly the configuration of the granular object color selector which can sort out conventional defective and foreign matter. Or let offer of the granular object sorting technique whose implementation was enabled only by adding some to old equipment, and its equipment be a technical technical problem.

[0008]

[Means for Solving the Problem] moving the sorted out raw material containing the excellent article and defective of a sorting object, and the other foreign matter, in order to solve the aforementioned technical problem By irradiating the light and near-infrared light at the sorted out raw material which moves, carrying out light-receiving analysis of the optical information based on the light obtained from a sorted out raw material, and carrying out light-receiving analysis of the optical information based on the near-infrared light obtained from a sorted out raw material It considered as the granular object sorting technique equipped with the process which carries out exclusion sorting of the defective from a sorted out raw material based on the analysis result of the optical information about the light which received light, and the process which carries out exclusion sorting of the foreign matter from a sorted out raw material based on the analysis result of the optical information about the near-infrared light which received light.

[0009] This eliminates a foreign matter and a defective individually, even if it does not incorporate an excessive circuit by making into the independent circuit each of the signal circuit which receives the optical information about the light and carries out exclusion sorting of the defective based on the analysis result of the optical information, and the signal circuit which receives the optical information about near-infrared light, and carries out exclusion sorting of the foreign matter based on the analysis result of the optical information, and it enables three sort sorting certainly. That is, three sort sorting is attained with a cheap circuit, without a foreign matter mixing in a defective by carrying out like this.

[0010] If foreign matters are an excellent article and an equivalent color and are the raw materials which are coloring only the defective when it considers as the configuration which performs the process which more specifically performs previously the process which carries out exclusion sorting of the defective, and next carries out exclusion sorting of the foreign matter After carrying out exclusion sorting only of the tinction grain which is a defective from a sorted out raw material using the optical information on the light corresponding to the tinction defective, a foreign matter and a defective can be separately sorted out by carrying out exclusion sorting only of the foreign matter from the sorted out raw material that of a defective exhausted using the optical information on the near-infrared light corresponding to the foreign matter. By the way, the excellent article and the defective, and foreign matter of a sorting object require that a clear difference should be detectable in the optical information acquired by irradiating near-infrared light, and it is required to be the wavelength region of the near-infrared light which the difference produces.

[0011] Moreover, when it considers as the configuration which performs the process which performs previously the process which carries out exclusion sorting of the foreign matter, and next carries out exclusion sorting of the defective, there are no conditions in the color of the foreign matter of a sorted out raw material. Exclusion sorting only of the foreign matter can be first carried out certainly from a sorted out raw material using the optical information on near-infrared light. Even if exclusion sorting will be similarly performed by the detection by the optical information by the light at this

time since exclusion sorting of the foreign matter is previously carried out by the detection for the optical information on near-infrared light although it will detect also for the optical information by the light and an exclusion sorting operation will be carried out if a foreign matter is the color different from an excellent article, there is no foreign matter of relevance and it is finished with a wide swing. Thus, since exclusion sorting only of the defective can be carried out from the sorted out raw material which a foreign matter is lost and flows, from a sorted out raw material, a foreign matter and a defective can be sorted out separately. Therefore, a defective and a foreign matter can be separately sorted out like the above-mentioned in the circuit which became independent with near-infrared light and the light, respectively.

[0012] Furthermore, in the above-mentioned case, the view which receives the optical information about near-infrared light, and the view which receives the optical information about the light can realize this application with a configuration equivalent to the conventional color sorting machine in considering as the same view. Moreover, this application is [that what is necessary is just to add another ejector to the conventional color sorting machine by arranging arrangement of a means, for example, an ejector etc., to eliminate a foreign matter and a defective, along the same passage of a sorted out raw material] realizable with the configuration which does not change this with the conventional color sorting machine, either.

[0013] In moreover, the configuration which connected the signal which receives the optical information about the light and, on the other hand, carries out exclusion sorting of the defective based on the analysis result of the optical information to exclusion functions, such as an ejector As a configuration which added the signal which receives the optical information about near-infrared light, and carries out exclusion sorting of the foreign matter based on the analysis result of the optical information to the one aforementioned ejector through the OR circuit After carrying out exclusion sorting of a defective and the foreign matter, it can also consider as the configuration which prepares the circuit which receives the optical information about near-infrared light which became independent still independently, and carries out exclusion sorting of the foreign matter based on the analysis result of the optical information. That is, a defective and a foreign matter can be certainly sorted out separately by carrying out exclusion sorting of a defective and the foreign matter at once from a sorted out raw material, and carrying out exclusion sorting of the foreign matter for this defective and foreign matter as a sorted out raw material after this. Since it can perform for the optical information on the near-infrared light which is unrelated to the color of a foreign matter, carrying out exclusion sorting of the foreign matter from the sorted out raw material which consists of a defective and a foreign matter can eliminate a foreign matter exactly.

[0014] If it is made the configuration which considered this for the first half as primary sorting which carries out exclusion sorting of a defective and the foreign matter at once, considered the second half as secondary sorting which carries out exclusion sorting of the foreign matter, and separated the case, it can consider as the selector of the configuration of the color sorting machine which enabled sorting of the conventional excellent article, and a defective and a foreign matter, and the sorting machine which irradiates near-infrared light and sorts out a foreign matter. This is realizable [this application] by adding a sorting machine equipped with the function which irradiates near-infrared light at this and sorts out a foreign matter, without exchanging an established color sorting machine. Of course, it is desirable to introduce not the thing that denies the one-granular object sorting machine equipped with primary and the secondary sorting function mentioned above but the one-granular object sorting machine equipped with primary and the secondary sorting function by this application in the new facility.

[0015]

[Embodiments of the Invention] The 1st example of the granular object sorting machine 1 which applied this invention to drawing 1 is shown in drawing 1 . A part of whole structure is omitted, and drawing 1 expands and shows the principal part. In addition, the example of a sorted out raw material (only henceforth a "raw material") is especially used as grain here, and it explains as foreign matters, such as a defective, a stone, glass, etc., such as a white-rice excellent article and a tinction grain of a white rice.

[0016] The upper part of the granular object sorting machine 1 is equipped with the reservoir tank 2 which stores a raw material, and it has the feeder 3 which discharges a raw material the optimum

dose every from the reservoir tank 2 in the lower part. The raw material by which optimum-dose issue is carried out from a feeder 3 is thrown into the following optical detecting element 5 along with chute 4, slipping down the inclined chute 4. A feeder 3 and the chute 4 may be conveyance means, for example, may be the thing of a conveyer specification, and should just have the structure which can be discharged the optimum dose every at the following process.

[0017] The optical detecting element 5 makes a view any-selected-point O in the fall tracing of a raw material, is arranged forward and backward, and consists of last optical department 5a and crepuscular-rays faculty 5b. Each optical department 5 is equipped with the background 8 and 9 which serves as the fluorescent lamp 6 for the lights, and the halogen lamp 7 for near-infrared and an orientation plate as a lighting means, respectively. The color of a fluorescent lamp 6 is changed according to the color of the defective eliminated as a tinction grain, or may be made to be equipped with two or more fluorescent lamps with two or more colors. Moreover, the halogen lamp 7 should also be changed into other lighting means according to the wavelength domain of near-infrared light needed for sorting. As for the background 8 and 9, it has 8 for near-infrared light, and 9 for the lights. The fluorescent lamp which is the lighting means of this example will choose suitably the fluorescent lamp of color suitable for recognizing a white rice and defectives, such as a tinction grain, and detecting a defective, and the halogen lamp for near-infrared light etc. will choose suitably the lighting of near-infrared light suitable for recognizing a foreign matter and a white rice and detecting a foreign matter.

[0018] To each of the optical department 5 of order, it has the light-receiving camera (henceforth "NIR camera") 10 and the camera for the lights 11 (henceforth a "CCD camera") for near-infrared light, and focusing on view O, these stand face to face against the background corresponding to each, and are arranged. That is, NIR camera 10a is arranged so that face to face may be stood against background 8a focusing on view O, and CCD camera 11a is arranged so that face to face may be stood against background 9a. NIR camera 10b and CCD camera 11b are arranged similarly. The background 8 which stands face to face against the NIR camera 10 makes the background used as criteria so that it may be easy to detect a foreign matter, in case a raw material passes through a background 8 front, and the background 9 which stands face to face against CCD camera 11 makes the background which serves as criteria so that it may be easy to detect a defective, in case a raw material passes through a background 9 front. By the way, it is good to use the sensor which accumulated InGaAs photo detector as a NIR camera. Moreover, it is good to use the photo sensor which is used for a video camera and accumulated the photo detector [like] as a CCD camera.

[0019] From view O, the exclusion equipment 12 (henceforth "an ejector 12") for near-infrared light and the exclusion equipment for the lights 13 (henceforth "an ejector 13") meet the tracing down which a raw material flows, and are arranged in order at the place which downed further. Each ejector 12 and 13 is connected with solenoid valves 14 and 15 by the air pipe. Moreover, it connects by the air pump and air hose not to illustrate, and these solenoid valves 14 and 15 are driven by the driving signal sent from the control unit mentioned later, and send out the air of an air pump to each of an ejector 12.13. Ejectors 12 and 13 make air blow off in the falling raw material at sending out of this air, and a defective and a foreign matter can be eliminated.

[0020] The raw material eliminated by the near-infrared light ejector 12 is discharged outside the plane from an exhaust port 16. The raw material eliminated by the light ejector 13 is discharged outside the plane from an exhaust port 17. The raw material eliminated by neither of both ejectors 12 and 13 is discharged outside the plane from an exhaust port 18. Thus, three sorts of raw materials can be sorted out.

[0021] Furthermore, if drawing 2 is added and explained, the reflected light signal of the raw material detected by each sensor (10, 11) from view O will be processed by the control unit 19. The control unit 19 is equipped with the comparator [signal / which was amplified with the amplifier 20 which amplifies the reflected light signal by each sensor / reference value] 21, the delay circuit 22 to which the time delay according to the distance of a sensor (10, 11) position and an ejector (12, 13) position is set, and the drive circuit 23 which outputs a driving signal to solenoid valves 14 and 15 through this circuit 22. Solenoid valves 14 and 15 operate by this driving signal, air blows off from an ejector (12, 13), and exclusion sorting of the defective or foreign matter detected by the sensor (10, 11) is carried out. The above amplifier 20, the comparator 21, the delay circuit 22, and the drive

circuit 23 are formed as a circuit which became independent by the NIR sensor 10 and the CCD sensor 11, and amplifier 20 and the comparator 21 are further formed independently to order for every sensor class, respectively. And one ejectors 12 and 13 are allotted to the couple of the NIR sensor 10 of order, and each of each couple of the CCD sensor 11 of order. That is, if a comparator 21 detects a foreign matter with one light-receiving signal of the NIR sensors 10a and 10b arranged forward and backward, a fixed time delay will be set, only a solenoid valve 14 will operate, air will blow off from an ejector 12, and a foreign matter will be eliminated. On the other hand, if a comparator 21 detects a defective with one light-receiving signal of the CCD sensors 11a and 11b arranged forward and backward, a fixed time delay will be set, only a solenoid valve 15 will operate, air will blow off from an ejector 13, and a defective will be eliminated. In other words, the signal of NIR sensor and CCD sensor is mutually alike, and does not interfere in a certain type, for example, one signal is not used as a cancel signal of another side, or the matrix using both signals is not created, therefore the circuit for it does not exist in this application.

[0022] By the way, a control unit 19 may connect a control panel 24 while it controls a drive of a feeder 3 further. That is, if operation of equipment 1 is started by operation of a control panel 24, a feeder 3 will drive and an injection of a raw material will be started. Moreover, a drive of ***** 3 cannot be abruptly supplied by the maximum stream flow, but it can also be controlled so that the amount of supply increases gradually. In addition, although it described on the assumption that the reflected light signal of a raw material was detected by the sensor here, you may constitute so that both the thing for which a transmitted light signal is detected or a transmitted light signal, and a reflected light signal may be detected.

[0023] An operation of each ejector at the time of detecting each of the excellent article which exists in the raw material when throwing in a raw material with the above configuration, and a defective and a foreign matter is shown in Table 1.

[Table 1]

	近赤外光の光情報 によるイジェクタ作動	可視光の光情報 によるイジェクタ作動
白米	OFF	OFF
着色米	OFF	ON
黒石	ON	ON
透明ガラス	ON	OFF

When each sensor (10, 11) detects the reflected light of a white rice as an optical information, air is not injected from both ejectors 12 and 13, but there is what [no], it passes and a white rice is discharged outside the plane from an exhaust port 18. If each sensor detects the reflected light of the tinction grain with which a white rice and color are different as an optical information, air will not be injected from the ejector 12 by the side of the NIR sensor 10, but air is injected only from the ejector 13 by the side of the CCD sensor 11, exclusion sorting of the tinction grain which is a defective is carried out by the ejector 13, and it is discharged outside the plane from an exhaust port 17. When the reflected light of the transparent glass each sensor of whose is a foreign matter is detected as an optical information, air is injected only from the ejector 12 by the side of the NIR sensor 10, exclusion sorting of the transparent glass which is a foreign matter is carried out by the ejector 12, and it is discharged outside the plane from an exhaust port 16. At this time, air is not injected from the ejector 13 by the side of the CCD sensor 11. When the reflected light of Kuroishi each sensor of whose is a foreign matter is detected as an optical information, air is injected from both the ejector 12 by the side of the NIR sensor 10, and the ejector 12 by the side of the CCD sensor 11. In this case, since the ejector 12 by the side of the NIR sensor 10 is arranged to the upper part of the ejector 13 by the side of CCD, the distance from view O differs and the time delays of a delay circuit 22 differ, an ejector 12 injects ahead of an ejector 13, and as shown in drawing 3, Kuroishi of the foreign matter of 102 is eliminated by the ejector 12 among the grain 100-103 which flows continuously. Since Kuroishi 102 is already eliminated although an ejector 13 injects when it flows down then and the grain of 100-103 (grain 102 does not exist) moves to a drawing 4 position, injection of an ejector 13

is swinging wide and excessive grain is not eliminated at a defective side.

[0024] Since the ejector 12 connected to the circuit of the NIR camera 10 though the driving signal was taken out with both circuits of the NIR camera 10 and CCD camera 11 even if the 1st characteristic feature of this application is here and it did not prepare a special circuit is allotted to the position operated ahead of the ejector 13 linked to the circuit of CCD camera 11, a foreign matter is accidentally eliminated to a defective side, and a foreign matter does not mix in a defective. When the black stone caught by both the NIR camera 10 and CCD camera 11 in them if an ejector 12 and the ejector 13 are allotted to the same position passes, this Ejectors 12 and 13 operate simultaneously in the same position, and exclusion sorting is carried out at any by the side of a defective and a foreign matter, or it is unknown, and a foreign matter mixes in a defective side, Or the reverse mixing is also expected and the defective and foreign matter which are one purpose of this application cannot be classified by one selector. It can realize only by adding an ejector to the conventional selector, without making exclusion exactly, and a major change's not having three sort sorting, either, and skyrocketing the price of equipment by carrying out the position which eliminates further the circuit for near-infrared light, and the circuit for the lights as another independent circuit like the above to a different position. By the way, even if the injection orientation of each ejector is not the same orientation like an example, it may prepare a suitable angle mutually.

[0025] By the way, when the foreign matters in a raw material are an excellent article white rice and an equivalent color, this application can be realized, even if it replaces arrangement of the upper and lower sides with the ejector 13 by the side of the CCD sensor 11, and the ejector 12 by the side of the NIR sensor 10, as shown in the drawing 5 and the drawing 6.

[Table 2]

	近赤外光の光情報 によるイジェクタ作動	可視光の光情報 によるイジェクタ作動
白米	OFF	OFF
着色米	OFF	ON
白い石	ON	OFF
透明ガラス	ON	OFF

That is, as shown in drawing 5, even if it is as Table 2 showing and grain 104-106 passes, an operation of each ejector When a foreign matter detects the optical information on the stone 105 with white white rice and equivalent color, or transparent glass, only the ejector 12 by the side of the NIR sensor 10 operates. As shown in drawing 6, only when the ejector 13 by the side of the CCD sensor 11 detects the optical information on tinction rice 108, it will operate, and the defective and foreign matter by which exclusion sorting was carried out are not mixed. In addition, it is effective to allot an ejector to the position which is different as shown in drawing 5 and the drawing 6 in this case. If it allots two or more ejectors to the same position since [to some extent] a time continuation is carried out and it is injected in order that one injection of an ejector may ensure exclusion sorting, following un-arranging will arise. That is, when the ejector 13 by the side of the CCD sensor 11 and the ejector 12 by the side of NIR side sensor 10 repeat injection by turns etc., It will not be avoided that 1 time of mutual injection time overlaps even if injection is shifted by turns, but a part of injection of an ejector will lap. Although not avoided, it carries out that the defective and foreign matter which were being eliminated at once by injection of an ejector will be in the mixture status in an injection position, and fractionation of a foreign matter and a defective becomes uncertain to the position which is different in the position of an ejector like this application, By making the NIR sensor 10 and the CCD sensor 11 into the independent circuit, sorting of a defective and a foreign matter can be ensured, and it can realize, without moreover skyrocketing the price of equipment.

[0026] Next, about the 2nd example which applied this invention, the drawing 7 or the drawing 10 explains the configuration. Here, the fraction greatly different from the 1st example constitutes the granular object selector shown in drawing 9 by the secondary sorting section 40 shown in the primary sorting section 30 shown in drawing 7, and the drawing 8.

[0027] The primary sorting section 30 first shown in drawing 7 equips the upper part of the granular object sorting machine 30 with the reservoir tank 2 which stores a raw material, and is equipped with

the feeder 3 which discharges a raw material the optimum dose every from the reservoir tank 2 in the lower part. The raw material by which optimum-dose issue is carried out from a feeder 3 is thrown into the following optical detecting element 5 along with chute 4, slipping down the inclined chute 4. A feeder 3 and the chute 4 may be conveyance meanses, for example, may be the thing of a conveyer specification, and should just have the structure which can be discharged the optimum dose every at the following process.

[0028] The optical detecting element 5 makes a view any-selected-point O in the fall tracing of a raw material, is arranged forward and backward, and consists of last optical department 5a and crepuscular-rays faculty 5b. Each optical department 5 is equipped with the background 8 and 9 which serves as the fluorescent lamp 6 for the lights, and the halogen lamp 7 for near-infrared and an orientation plate as a lighting means, respectively. As for the background 8 and 9, it has 8 for near-infrared light, and 9 for the lights. To each of the optical department 5 of order, it has the light-receiving camera (henceforth "NIR camera") 10 and the camera for the lights 11 (henceforth a "CCD camera") for near-infrared light, and focusing on view O, these stand face to face against the background corresponding to each, and are arranged. That is, NIR camera 10a is arranged so that face to face may be stood against background 8a focusing on view O, and CCD camera 11a is arranged so that face to face may be stood against background 9a. NIR camera 10b and CCD camera 11b are arranged similarly.

[0029] It is arranged at the place which downed further from view O so that the exclusion equipment 31 (henceforth "an ejector 31") may meet the tracing down which a raw material flows. The ejector 31 is connected with the solenoid valve 32 by the air pipe. Moreover, it connects by the air pump and air hose not to illustrate, and this solenoid valve 32 is driven by the driving signal sent from the control unit mentioned later, and sends out the air of an air pump to an ejector 31. An ejector 31 makes air blow off in the falling raw material at sending out of this air, and a defective and a foreign matter can be eliminated. The raw material eliminated by the ejector 31 is discharged outside the plane from an exhaust port 33. The raw material which was not eliminated by the ejector 31 is discharged outside the plane from an exhaust port 18. Thus, two sorts of raw materials can be sorted out.

[0030] The reflected light signal of the raw material detected by each sensor (10, 11) from view O is processed by the control unit 34. The control unit 34 is equipped with the comparator [signal / which was amplified with the amplifier 20 which amplifies the reflected light signal by each sensor as shown in drawing 10 / reference value] 21, the delay circuit 22 to which the time delay according to the distance of a sensor (10, 11) position and an ejector (31) position is set, and the drive circuit 48 which outputs a driving signal to a solenoid valve 32 through this circuit 22 and OR circuit 47. A solenoid valve 32 operates by this driving signal, air blows off from an ejector 31, and exclusion sorting of the defective or foreign matter detected by the sensor (10, 11) is carried out. It has prepared as a circuit where the above amplifier 20, the comparator 21, and the delay circuit 22 became independent by the NIR sensor 10 and the CCD sensor 11, and amplifier 20 and the comparator 21 are further formed independently to order for every sensor class, respectively. And the signal of the couple of the NIR sensor 10 of order and each couple of the CCD sensor 11 of order is compounded by OR circuit 47, and it is made to drive one ejector 31 also with one of signals. That is, when a comparator 21 detects a foreign matter with one light-receiving signal of the NIR sensors 10a and 10b arranged forward and backward, or when a comparator 21 detects a defective with one light-receiving signal of the CCD sensors 11a and 11b arranged on order, a fixed time delay is set, a solenoid valve 32 operates, air blows off from an ejector 31, and a defective and a foreign matter are eliminated. In here, besides compounding by the OR circuit, the signal of NIR sensor and CCD sensor is mutually alike, and interferes in a certain type, for example, one signal is not used as a cancel signal of another side, or the matrix using both signals is not *****ed, therefore the circuit for it does not exist in this application.

[0031] As primary sorting of drawing 9 shows, sorting here classifies a primary raw material to two sorts of an excellent article, and a defective and a foreign matter, and has the same sorting function as the so-called conventional color sorting machine. When a raw material is thrown in with the above configuration, an operation of the ejector 31 at the time of detecting each of the excellent article which exists in a raw material, and a defective and a foreign matter is shown in Table 3.

[Table 3]

	近赤外光の光情報	可視光の光情報	エジェクタの作動
白米	OFF	OFF	OFF
着色米	OFF	ON	ON
黒石	ON	ON	ON
透明ガラス	ON	OFF	ON

First, when each sensor (10, 11) detects the reflected light of a white rice as an optical information, air is not injected from an ejector 31, but there is what [no], it passes and a white rice is discharged outside the plane from an exhaust port 18. Exclusion sorting of the tinction grain which the signal from delay circuit 22a by the side of the NIR sensor 10 will not be outputted if the reflected light of the tinction grain from which a white rice and color are [each sensor] different is detected as an optical information, but delay circuit 22b by the side of the CCD sensor 11 to a signal is outputted, and a solenoid valve 32 drives by the drive circuit 48 through OR circuit 47, and is a defective is carried out by injection of an ejector 31, and it is discharged from an exhaust port 33 to outside the plane. When the reflected light of the transparent glass each sensor of whose is a foreign matter is detected as an optical information, through OR circuit 47, a signal is outputted only from delay circuit 22a by the side of the NIR sensor 10, a solenoid valve 32 drives, by injection of an ejector 31, exclusion sorting of the transparent glass which is a foreign matter is carried out by the drive circuit 48, and it is discharged outside the plane from an exhaust port 33. At this time, a signal is not outputted from delay circuit 22b by the side of the CCD sensor 11. When the reflected light of Kuroishi each sensor of whose is a foreign matter is detected as an optical information, through OR circuit 48, a signal is outputted from both delay circuit 22b by the side of delay circuit 22a by the side of the NIR sensor 10, and the CCD sensor 11, a solenoid valve 32 drives, by injection of an ejector 31, exclusion sorting of Kuroishi which is a foreign matter is carried out by the drive circuit 48, and it is discharged outside the plane from an exhaust port 33.

[0032] Thus, the defective and foreign matter which were sorted out are thrown into the secondary sorting section 40 by the conveyance means (not shown) as a raw material. The configuration of the secondary sorting section 40 is shown in drawing 8 , and the fraction different from drawing 7 is explained. The optical department 41 arranged focusing on view O consists of last optical department 41a and crepuscular-rays faculty 41b, and equips each optical department with the halogen lamp 7, the background 8, and the fluorescent lamp for a lighting 6 for near-infrared light irradiation. Moreover, NIR camera 10b is arranged in the position which counters the position which counters background 8a focusing on view O with NIR camera 10a at background 8b. The ejector 42 is formed along with the tracing down which a raw material flows underneath the view O. The ejector 42 is connected with the solenoid valve 43 by the air pipe. Moreover, it connects by the air pump and air hose not to illustrate, and this solenoid valve 43 is driven by the driving signal sent from the control unit mentioned later, and sends out the air of an air pump to an ejector 42.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the 1st example of the granular object sorting machine which applied this invention.

[Drawing 2] It is the block diagram having shown the analysis circuit of the optical information in the 1st example.

[Drawing 3] It is drawing showing the status of exclusion sorting by the 1st example.

[Drawing 4] It is drawing showing the status of exclusion sorting by the 1st example.

[Drawing 5] It is drawing by the 1st example showing the status of another exclusion sorting.

[Drawing 6] It is drawing by the 1st example showing the status of another exclusion sorting.

[Drawing 7] It is drawing showing primary sorting of the 2nd example of the granular object sorting machine which applied this invention.

[Drawing 8] It is drawing showing secondary sorting of the 2nd example of the granular object sorting machine which applied this invention.

[Drawing 9] It is drawing having shown flowing of the raw material of the 2nd example.

[Drawing 10] It is the block diagram having shown the analysis circuit of the optical information on primary sorting by the 2nd example.

[Drawing 11] It is the block diagram having shown the analysis circuit of the optical information on secondary sorting by the 2nd example.

[Description of Notations]

- 1 Granular Object Sorting Machine
- 2 Reservoir Tank
- 3 Feeder
- 4 Chute
- 5 Optical Detecting Element
- 6 Fluorescent Lamp
- 7 Halogen Lamp
- 8 Background
- 9 Background
- 10 Light-receiving Camera for Near-infrared Light (NIR Camera)
- 11 Camera for Lights (CCD Camera)
- 12 Exclusion Equipment for Near-infrared Light (Ejector)
- 13 Exclusion Equipment for Lights (Ejector)
- 14 Solenoid Valve
- 15 Solenoid Valve
- 16 Exhaust Port
- 17 Exhaust Port
- 18 Exhaust Port
- 19 Control Unit
- 20 Amplifier
- 21 Comparator
- 22 Delay Circuit
- 23 Drive Circuit

- 24 Control Panel
- 30 Primary Sorting Section (Granular Object Sorting Machine)
- 31 Exclusion Equipment (Ejector)
- 32 Solenoid Valve
- 33 Exhaust Port
- 34 Control Unit
- 40 Secondary Sorting Section
- 41 Optical Department
- 42 Ejector
- 43 Solenoid Valve
- 45 Exhaust Port
- 46 Exhaust Port
- 47 OR Circuit
- 48 Drive Circuit
- 49 Control Unit

[Translation done.]

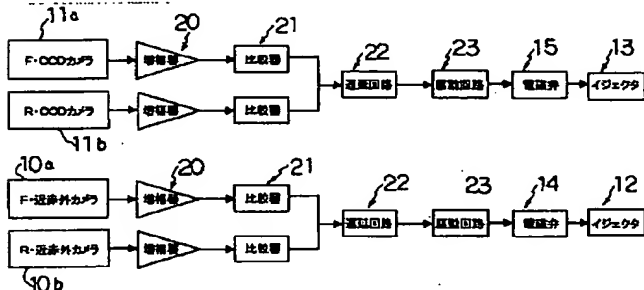
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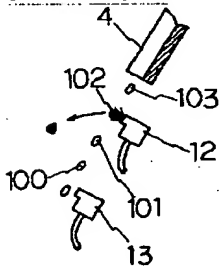
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DRAWINGS

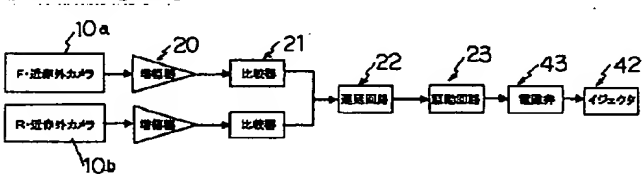
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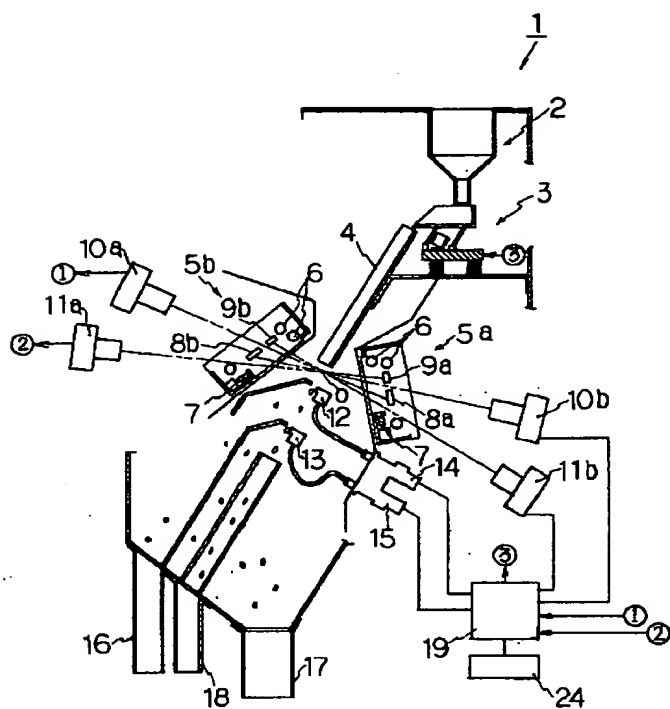
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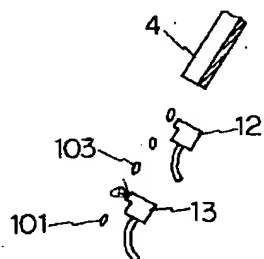
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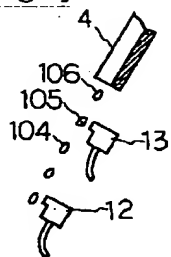
[Drawing 1]



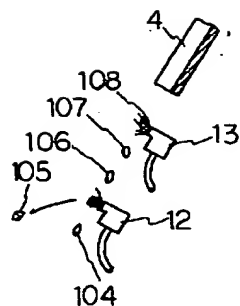
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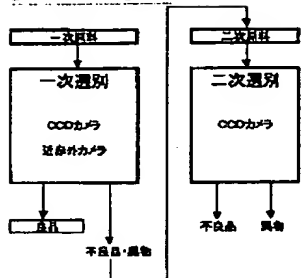
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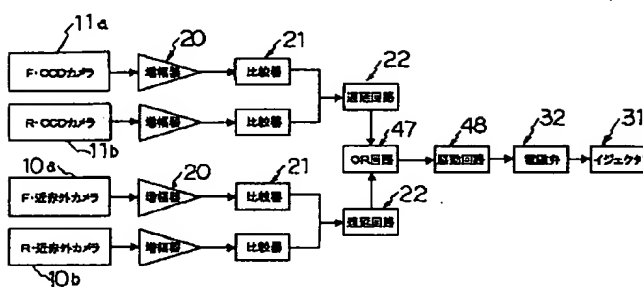
[Drawing 6]



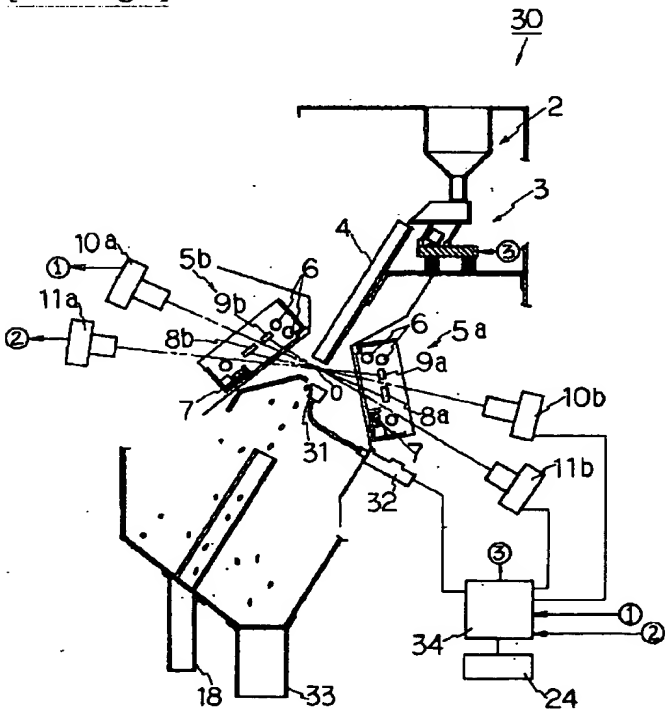
[Drawing 9]



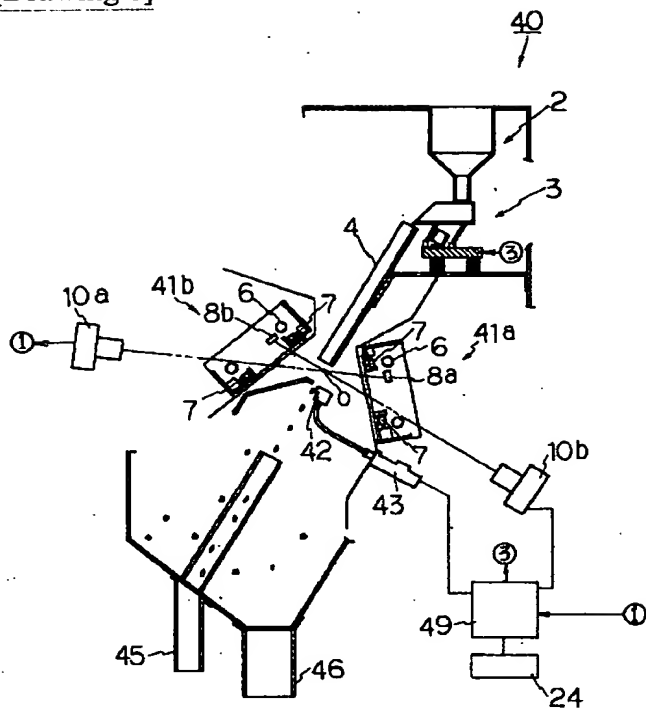
[Drawing 10]



[Drawing 7]



[Drawing 8]



[Translation done.]